

## Aluminium - zinc alloy coated steel sheets and coils (Bj.L AS)





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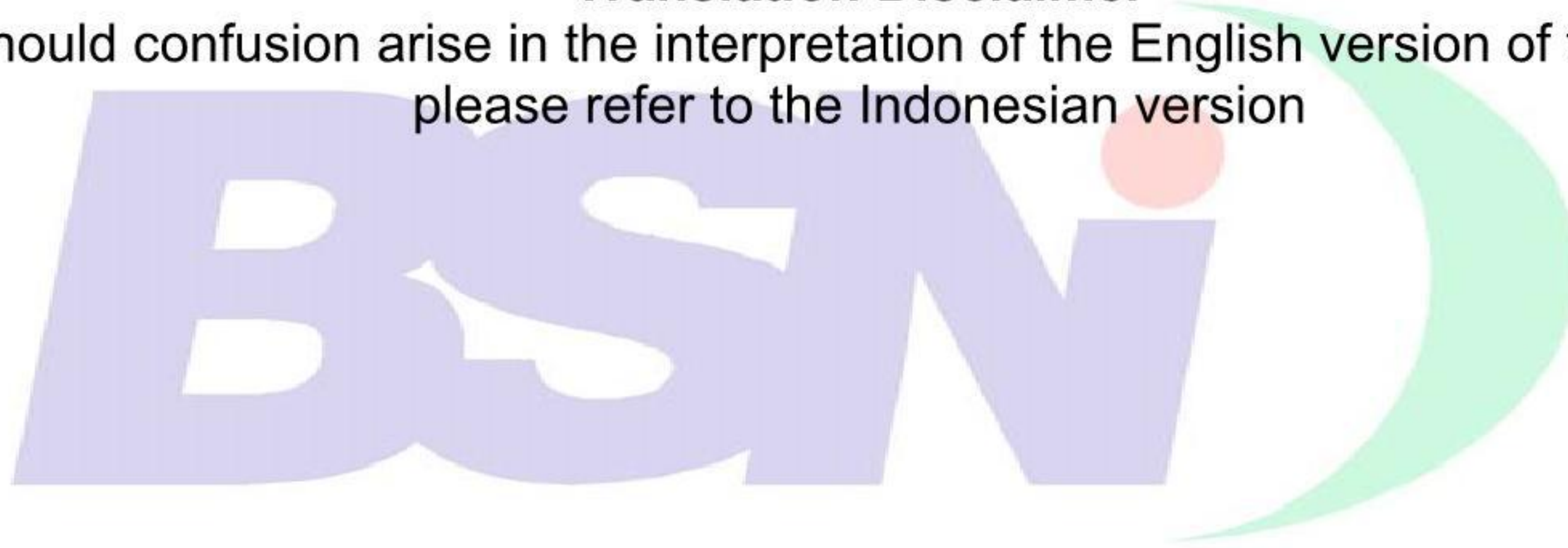
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## Introduction

Standar Nasional Indonesia (SNI) *Baja lembaran dan gulungan lapis paduan aluminium – seng (Bj.L AS)* is a revised edition of SNI 07-4096-1996, *Baja lembaran dan gulungan lapis lakur (paduan) aluminium-seng*.

This SNI was revised taking into the following consideration::

1. Development of the technology process manufacturing capabilities of Bj.L AS to fulfill the domestic and export markets needs.
2. To protect and assure the end consumer regarding product quality
3. To control nonstandard imported goods.
4. To apply the National System of Standardization to review the SNI standards every 5 years

The revision involves:

- Scope
- Normative references
- Terms and definitions
- Symbols, classifications and applications
- Quality specifications
- Sampling methods
- Test methods
- Acceptance requirements
- Marking

This standard was deliberated in technical committee meetings, pre-consensus and consensus meetings held in Jakarta on December 5<sup>th</sup>, 2006. These meetings were attended by members of the Technical Committee Metal, Steel and Steel Products, representatives from industry, consumers, testing institutions and other related government institutions. This standard has gone through a national consensus process by e-balloting during August 28<sup>th</sup> – October 28<sup>th</sup> 2007

This standard was drafted by the Technical Committee 77-01, Metal, Steel and Steel Products



## Aluminium- zinc alloy coated steel sheets and coils (Bj.L. AS)

### 1 Scope

This standard covers definitions, classifications, quality specifications, sampling, test methods, acceptance requirements and marking of aluminium (Al) - zinc (Zn) alloy coated steel sheets and coils

### 2 Normative references

SNI 07-0308-1989, *Cara uji komposisi kimia baja karbon*  
 SNI 07-0371-1998, *Batang uji tarik untuk bahan logam*,  
 SNI 07-0408-1989, *Cara uji tarik untuk logam*

### 3 Terms and definitions

#### 3.1

#### **Aluminium- zinc alloy coated steel sheets and coils (Bj.L. AS)**

coated steel sheets and coils are produced by hot dipping in a 50% - 60% aluminium, 40% - 50% zinc alloy and various other elements.

#### 3.2

#### **base metal (mother coil)**

cold rolled steel sheet coils

#### 3.3

#### **nominal thickness of Bj.L AS mother coil**

thickness in the center of cold rolled carbon steel coil in the rolling direction

#### 3.4

#### **nominal thickness tolerance of mother coil**

permitted tolerance limit of nominal thickness

#### 3.5

#### **yield strength**

lower yield strength limit. If the graph or test equipment does not show yielding, the yield strength is calculated by 0,2% offset method

### 4 Symbols, classifications and applications

The Bj.L-AS classification system is based on the minimum yield strength, minimum elongation, and aluminium-zinc coat mass, as presented in Table 1 and Table 2



**Table 1 - Classification of Bj.L-AS based on mechanical properties for a 50 mm gauge length**

No	Symbol	Lower yield strength (N/mm <sup>2</sup> )	Minimum elongation (%) L <sub>o</sub> = 50 mm	Application
1	Gi	-	-	Profile
2	G2	-	30	Commercial forming
3	G3	-	35	Drawing
4	G250	250	25	Structure and Commercial forming
5	G300	300	20	Structure and Commercial forming
6	G350	550	2	Structure

**NOTE 1** G1, G2 and G3 Tensile test specimen perpendicular to rolling direction.

**NOTE 2** G250, G300 and G550 Tensile test specimen parallel to rolling direction.

**Table 2 - Classification of Bj.L-AS based on coating mass**

No	Symbol	Coating mass per meter square
1	AS 50	50 g/m <sup>2</sup>
2	AS 70	70 g/m <sup>2</sup>
3	AS 100	100 g/m <sup>2</sup>
4	AS 150	150 g/m <sup>2</sup>
5	AS 200	200 g/m <sup>2</sup>

**NOTE 1** AS 50 for indoor application only

**NOTE 2** Based on coating mass tests on both surfaces – three test spots

## 5 Quality specifications

### 5.1 Base metal

#### 5.1.1 Nominal thickness and tolerances of base metal is presented in Table 3



Table 3 - Nominal thickness and tolerances of base metal

No.	Nominal thickness	Tolerance			
		$L \leq 630$	$630 < L \leq 1000$	$1000 < L \leq 1250$	$1250 < L \leq 1500$
1	0,20	$\pm 0,010$	$\pm 0,010$	$\pm 0,015$	-
2	0,25	$\pm 0,025$	$\pm 0,025$	$\pm 0,025$	-
3	0,27	$\pm 0,025$	$\pm 0,025$	$\pm 0,025$	-
4	0,30	$\pm 0,030$	$\pm 0,030$	$\pm 0,030$	-
5	0,35	$\pm 0,030$	$\pm 0,030$	$\pm 0,030$	-
6	0,40	$\pm 0,040$	$\pm 0,040$	$\pm 0,040$	$\pm 0,040$
7	0,42	$\pm 0,040$	$\pm 0,040$	$\pm 0,040$	$\pm 0,040$
8	0,45	$\pm 0,040$	$\pm 0,040$	$\pm 0,040$	$\pm 0,050$
9	0,50	$\pm 0,050$	$\pm 0,050$	$\pm 0,050$	$\pm 0,060$
10	0,55	$\pm 0,050$	$\pm 0,050$	$\pm 0,050$	$\pm 0,060$
11	0,60	$\pm 0,050$	$\pm 0,050$	$\pm 0,050$	$\pm 0,060$
12	0,65	$\pm 0,050$	$\pm 0,050$	$\pm 0,050$	$\pm 0,060$
13	0,70	$\pm 0,060$	$\pm 0,060$	$\pm 0,060$	$\pm 0,070$
14	0,75	$\pm 0,060$	$\pm 0,060$	$\pm 0,060$	$\pm 0,070$
15	0,80	$\pm 0,060$	$\pm 0,060$	$\pm 0,060$	$\pm 0,070$
16	0,85	$\pm 0,060$	$\pm 0,060$	$\pm 0,060$	$\pm 0,070$
17	0,90	$\pm 0,070$	$\pm 0,070$	$\pm 0,080$	$\pm 0,080$
18	0,95	$\pm 0,070$	$\pm 0,070$	$\pm 0,080$	$\pm 0,080$
19	1,00	$\pm 0,070$	$\pm 0,070$	$\pm 0,080$	$\pm 0,080$
20	1,10	$\pm 0,070$	$\pm 0,070$	$\pm 0,080$	$\pm 0,080$
21	1,20,1,20	$\pm 0,070$	$\pm 0,070$	$\pm 0,080$	$\pm 0,090$
<b>NOTE</b> L is the width of base metal					

### 5.1.2 Composition of coating material

The composition of coating alloy consists of 50%- 60% aluminium, 40% - 50% zinc and additional elements and is applied by hot dipping.

### 5.1.3 Chemical composition of base metal

The composition of the base metal is specified in Table 4 is in accordance with AS 1397 – 2001 (*Steel sheet and strip – Hot-dip zinc-coated or aluminium/zinc-coated*)



Table 4 - Chemical composition of base metal

Symbol	Chemical composition maximum (% weight)			
	C	Mn	P	S
G1	0,12	0,50	0,040	0,035
G2	0,10	0,45	0,030	0,030
G3	0,08	0,40	0,020	0,025
G250	0,12	0,50	0,040	0,035
G300	0,30	1,60	0,040	0,035
G550	0,20	1,20	0,040	0,030

#### 5.1.4 Mechanical properties

Mechanical properties specified in Table 5 is in accordance with AS 1397 - 2001 *Steel sheet and strip – hot-dip zinc-coated or aluminium/zinc-coated*

Table 5 - Mechanical properties

Symbol	Tensile test			Transverse bend test	
	Min. Yield strength (N/mm <sup>2</sup> )	Min. Tensile strength (N/mm <sup>2</sup> )	Min. elongation (%) Lo=50 mm	Bend angle (°)	Bend mandrel (t)
G1	-	-	-	180	0 t
G2	-	-	30	180	0 t
G3	-	-	35	180	0 t
G250	250	320	25	180	0 t
G399	300	340	20	180	1 t
G550	550	550	2	-	-
<p><b>NOTE 1</b> G1, G2 and G3 Tensile test specimen perpendicular to rolling direction</p> <p><b>NOTE 2</b> G250, G300 and G550 Tensile test specimen parallel to rolling direction</p> <p><b>NOTE 3</b> t is the thickness of test specimen.</p> <p><b>NOTE 4</b> Lo is the gauge length.</p>					

#### 5.2 Flake test of aluminium-zinc coating

The aluminium- zinc alloy coated steel sheets and coils shall be capable to withstand bending without flaking

#### 5.3 Bend test



The coated sheet shall be capable of being bent without cracking on the outside of the bend surface of the base metal.

#### 5.4 Workmanship (appearance)

The BjL AS coated surface shall be free from holes, tears, uncoated spots and other surface imperfections that can cause detrimental effects during application.

#### 5.5 Dimensions

##### 5.5.1 Width and tolerances of Bj.L AS coils are specified in Table 6

**Table 6 - Bj.L-AS width and tolerances**

Width (L)	Tolerance
$L < 1250 \text{ mm}$	+ 7 mm 0
$L \geq 1250 \text{ mm}$	+ 10 mm 0

##### 5.5.2 Length and tolerances of Bj.L AS flat sheets are specified in Table 7

**Table 7 - Length and tolerance of flat sheets**

Length (P)	Tolerance
$P < 2000 \text{ mm}$	+ 10 mm 0
$2000 \text{ mm} \leq P < 4000 \text{ mm}$	+ 15 mm 0
$4000 \text{ mm} \leq P < 6000 \text{ mm}$	+ 20 mm 0
$P \geq 6000 \text{ mm}$	+ 0,5 % (weighth) 0
<b>NOTE</b> For length > 6000 mm, for coils tolerance is expressed in weighth units	

#### 5.6 Flatness

Flatness of Bj.L AS, is expressed as steepness ratio, calculated by determining the ratio of maximum height between two waves of the sheet and the distance between the waves.

Flatness ratio for Bj.L AS grade A and with thickness  $\leq 1,7 \text{ mm}$  is maximum 1,2 % as shown in Figure 4.

#### 5.7 Edge camber

The maximum value for Bj.L AS edge camber is 0,20 % of the actual length, as shown in Figure 5.



### 5.8 Estimated thickness of Bj.LAS

The estimated thickness of Bj.L AS is specified in Table 8, where the thickness is the nominal base metal thickness plus the equivalent thickness of the aluminium – zinc coat.

**Table 8 - Estimated thickness of Bj.L AS**

Notation	Nominal thickness of base metal (mm)	Nominal thickness of Bj.L AS (mm)				
		AS 200	AS 150	AS 100	AS 70	AS 50
		Equivalent thickness of coating on both sides (mm)				
		0,060	0,046	0,027	0,019	0,015
Bj.L AS-20	0,20	0,260	0,246	0,227	0,219	0,215
Bj.L AS-25	0,25	0,310	0,296	0,277	0,269	0,265
Bj.L AS-27	0,27	0,330	0,316	0,297	0,289	0,285
Bj.L AS-30	0,30	0,360	0,346	0,327	0,319	0,315
Bj.L AS-35	0,35	0,410	0,396	0,377	0,369	0,365
Bj.L AS-40	0,40	0,460	0,446	0,427	0,419	0,415
Bj.L AS-42	0,42	0,480	0,466	0,447	0,439	0,435
Bj.L AS-45	0,45	0,510	0,496	0,477	0,469	0,465
Bj.L AS-50	0,50	0,560	0,546	0,527	0,519	0,515
Bj.L AS-55	0,55	0,610	0,595	0,577	0,569	0,565
Bj.L AS-60	0,60	0,660	0,646	0,627	0,619	0,615
Bj.L AS-65	0,65	0,710	0,696	0,677	0,669	0,665
Bj.L AS-70	0,70	0,760	0,746	0,727	0,719	0,715
Bj.L AS-75	0,75	0,810	0,796	0,777	0,769	0,765
Bj.L AS-80	0,80	0,860	0,846	0,827	0,819	0,815
Bj.L AS-85	0,85	0,910	0,896	0,877	0,869	0,865
Bj.L AS-90	0,90	0,960	0,946	0,927	0,919	0,915
Bj.L AS-95	0,95	1,010	0,996	0,977	0,969	0,965
Bj.L AS-100	1,00	1,060	1,046	1,027	1,019	1,015
Bj.L AS-110	1,10	1,160	1,146	1,127	1,119	1,115
Bj.L AS-120	1,20	1,260	1,246	1,227	1,219	1,215

**NOTE 1** Notation indicates the nominal thickness of base metal

**NOTE 2** Bj.L-AS aluminium-zinc coat equivalent thickness on both sides shall be calculated empirically

### 5.9 Mass and tolerances of aluminium-zinc coat

Minimum mass of Bj.L AS aluminium-zinc coating is specified in Table 9



**Table 9 - Minimum mass of aluminium-zinc coating**

Symbol	Minimum mass of aluminium-zinc coating (g/m <sup>2</sup> )		
	Two surfaces		One surface
	Triple-spot test (average)	Single-spot test (individual)	Single-spot test (individual)
AS 200	200	180	80
AS 150	150	135	60
AS 100	100	90	40
AS 70	70	63	28
AS 50	50	45	20

**Mass calculation of Bj.L-AS sheets and coils**

The theoretical calculation of the total mass of Bj.L-AS sheets and coils expressed in M kg units are conducted as follows:

Massa/m<sup>2</sup> of base metal calculation is

$$M = \frac{\rho d}{1000}$$

Where

M is the base metal mass per m<sup>2</sup>

$\rho$  is the specific mass of steel (7850 kg/m<sup>3</sup>)

d is thickness of steel (mm)

Calculation of mass per m<sup>2</sup> Bj.L-AS is:

M (Bj.L-AS) = M + coat mass constant

Example:

1) For AS 200 with base metal thickness of 1,20 mm:

$$M = \frac{7850 \times 1,2}{1000} = 9,420 \text{ kg/m}^2$$

2) Coat mass constant for AS 200 = 0,2000 kg/m<sup>2</sup>;

3) Mass of 1 m<sup>2</sup> Bj.L-AS = 9,400 + 0,2000 = 9,6200 kg/m<sup>2</sup>

4) Accuracy of this calculation is 4 (four) significant numbers

**Table 10 - Mass constant and coating grade for mass calculation (total two surfaces)**

Symbol	Coat mass constant (g/m <sup>2</sup> )
AS 200	200
AS 150	150
AS 100	100
AS 70	70
AS 50	50



## 6 Sampling

**6.1** Sampling shall be conducted by authorized personnel in accordance with existing rules

**6.2** Bj.L-AS coils with the same specification up to 50 tonnes are represented by 1 (one) sample sheet, 1 (one) meter in length and from subsequent multiple of 50 (fifty) tonnes another sample sheet shall be taken but not more than 10 (ten) samples.

**6.3** Bj.L-AS sheets of the same specification exceeding 3000 sheets, one sample shall be taken. From subsequent multiple of 3000 sheets 1 (one) sample sheet shall be taken but not more than 10 (ten) samples.

**6.4** Samples shall be taken at random.

## 7 Test method

### 7.1 Appearance

Appearance test shall be determined visually without any auxiliary tools.

### 7.2 Carbon steel chemical composition test

Chemical composition of the base metal shall be determined in accordance with SNI 07-0308-1989, *Cara uji komposisi kimia baja karbon*

### 7.3 Thickness of base metal determination

The thickness of base metal Bj.L-AS shall be determined after the aluminium-zinc coating is removed.

Measure the thickness minimal at three spots in line, perpendicular to the rolling direction, one at the mid-width position of the sample sheet and two at the edges, not closer than 15 mm from the side edge, with tolerances as specified in Table 3. (Nominal thickness and tolerances of base metal).

### 7.4 Dimension

The dimension is measured using measurement calipers with an accuracy of 0,5 mm

### 7.5 Coating and bend test

**7.5.1** Test samples 75 mm x 125 mm shall be taken in transverse direction to the rolling direction.

**7.5.2** Test sample is bended 180° and the coated sheet shall be free from flaking at the outside of the bend edge. Whenever free from cracks/flakes the coating adherence is nil t (0t).

**7.5.3** Test sample is bended 180° and the coat shall be removed from the bend edge to examine the base metal. Whenever the base metal shows no cracks the bend-ability of the base metal is nil t (0t).

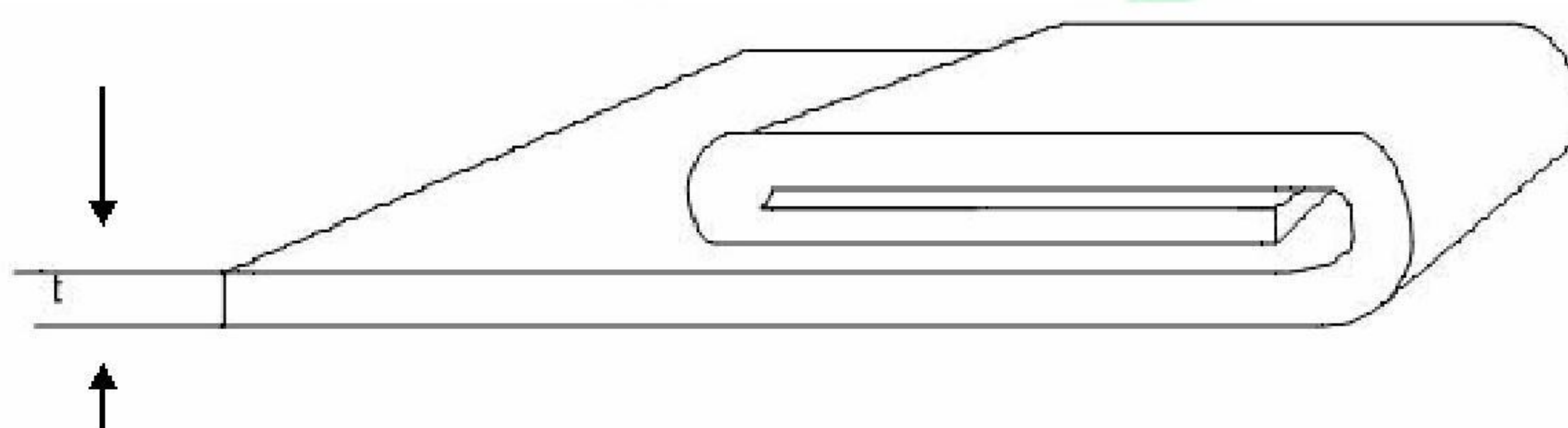
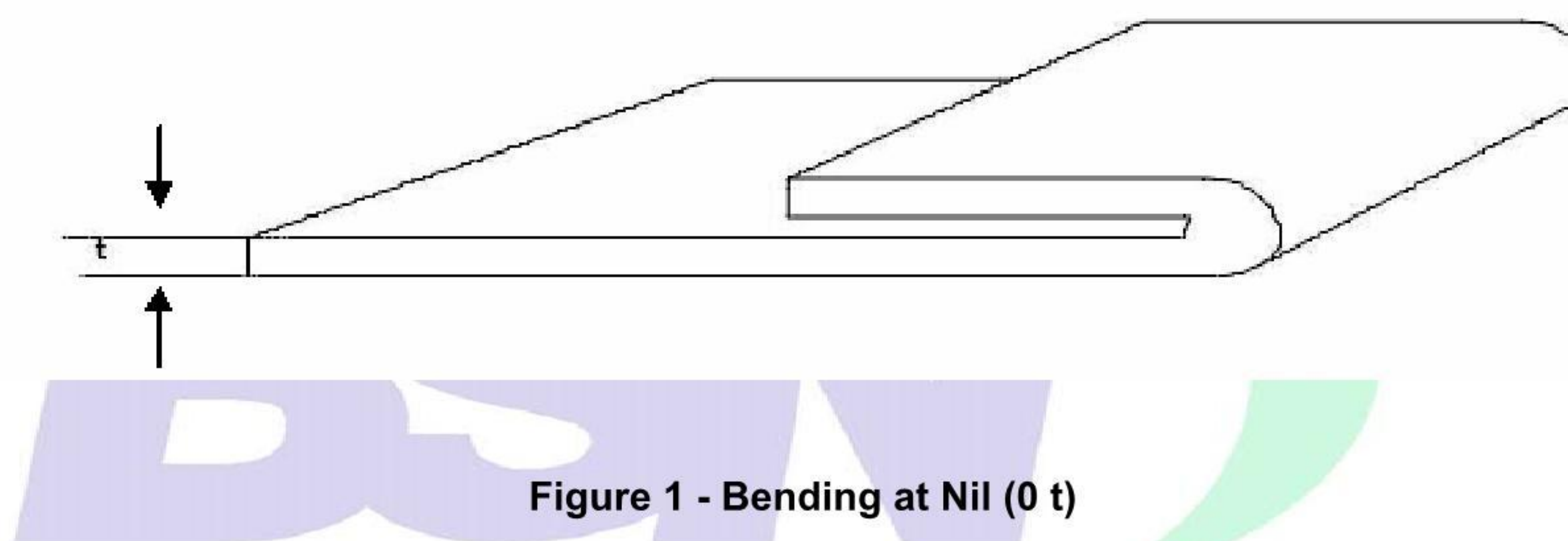
**7.5.4** The initial fold/bend is nil t and the consecutive fold/bend is one t (1t) etc.



7.5.5 The test results shall be in accordance with Table 11.

**Table 11 - Maximum bending (t) for coat test**

Symbol	Maximum bending				
	AS 200	AS 150	AS 100	AS 70	AS 50
BjL-AS-G1	0t	0t	0t	0t	0t
Bj.L-AS-G2	0t	0t	0t	0t	0t
BjL-AS-G3	0t	0t	0t	0t	0t
Bj.L-AS-G250	0t	0t	0t	0t	0t
BjL-AS-G300	1t	1t	1t	1t	1t
Bj.L-AS-G550	2t	2t	2t	2t	2t



## 7.6 Aluminium-zinc coating mass test

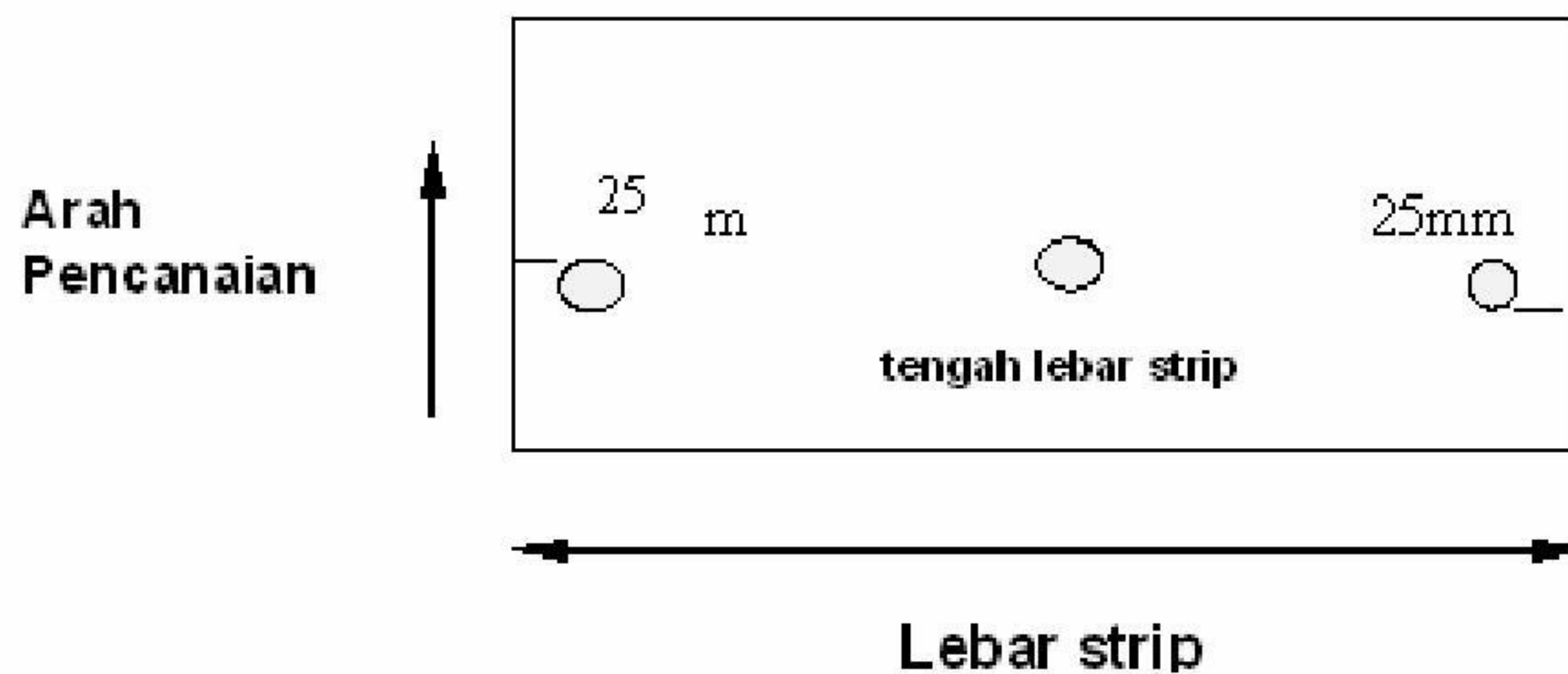
Coating mass test shall be determined on test samples according to three criteria

**7.6.1** The triple-spot test –two surfaces; shall be applied to three test samples taken from from one plate ( size 300 mm x full width); one cut mid-width and the others from both edges of the plate not closer than 25 mm from the side edge.

**7.6.2** The single spot test – two surfaces; shall be applied to any one test sample of the three test samples used for the triple-spot test.



**7.6.3** One surface single- spot test ; shall be applied to any side surface of of test samples used for the triple-spot test



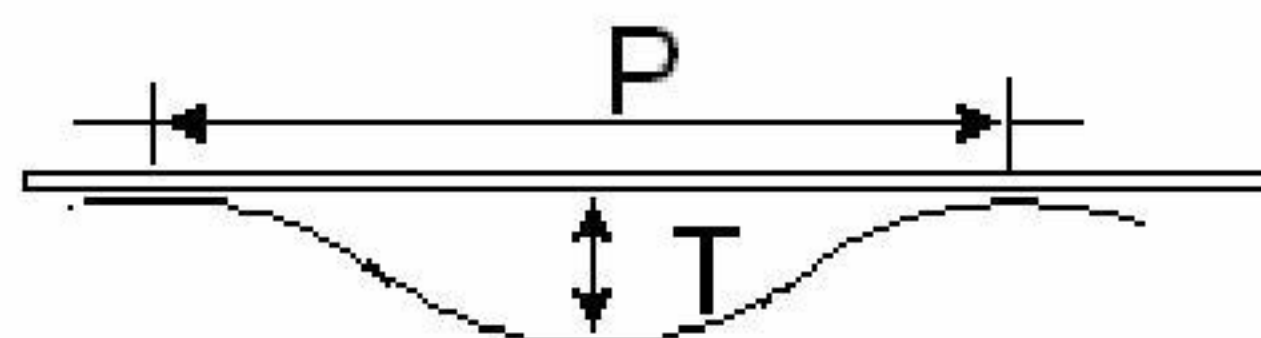
**Figure 3 - Determination of spot samples location for measuring the mass of aluminium-zinc coat**

## 7.7 Tensile test

Tensile test shall be carried out in accordance with SNI 07-0408-1989, *Cara uji tarik untuk logam* and SNI 07-0371-1998, *Batang uji tarik untuk bahan logam*.

## 7.8 Flatness test

Flatness is determined using the following equation:



### Figure notes:

P is the wave length (mm)

T is the wave height (mm)

**Figure 4 - Surface flatness**

Flatness ratio is determined using equation :

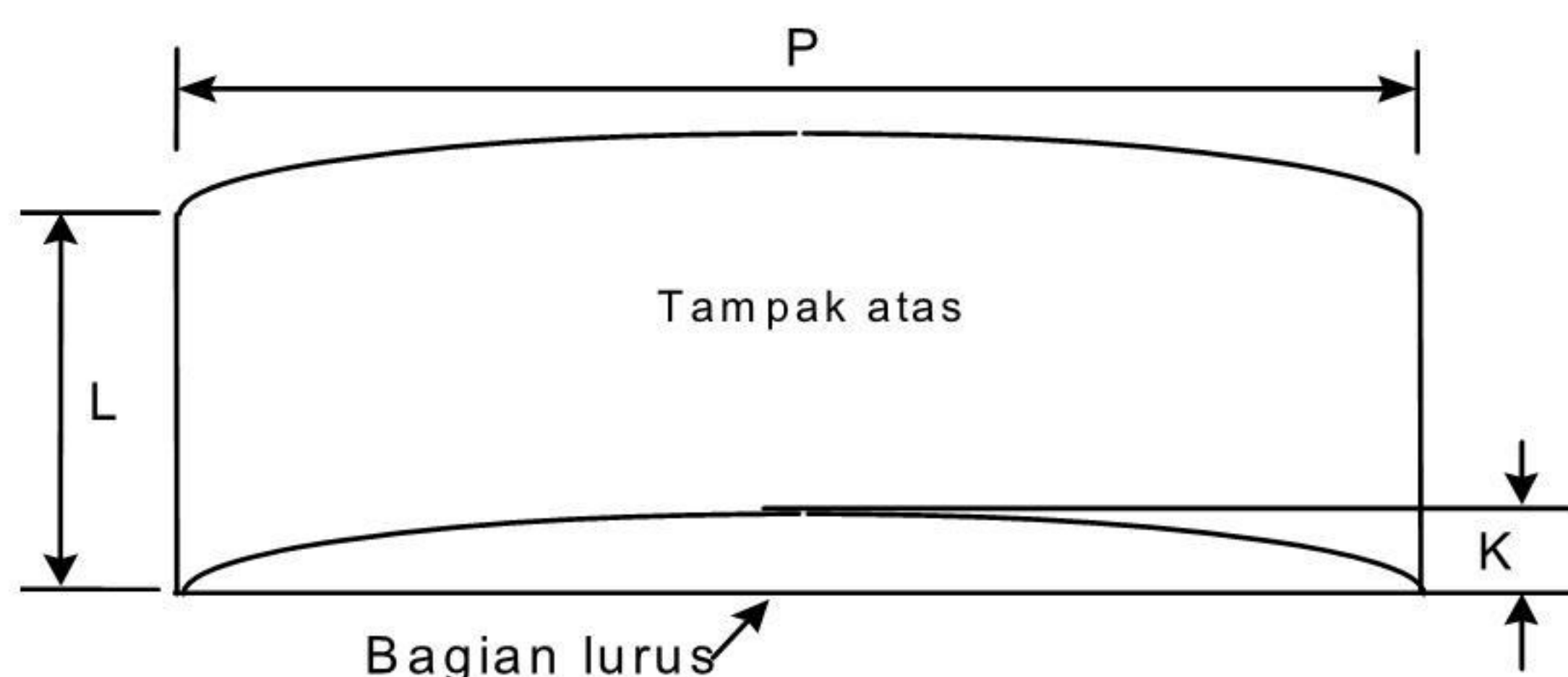
$$\text{Flatness ratio} = T / P \times 100 \%$$

Flatness test specification is referred in Table 8.



## 7.9 Camber test

Measurement of camber is based on the following formulation:



### Figure notes:

P is length (mm)

L is width (mm)

K is edge camber (mm)

Figure 5 - Edge camber

Edge camber value ( $K_c$ ) is measured using the following equation:

$$K_c = K / L \times 100 \%$$

The maximum value for side camber is specified in 5.7

## 8 Acceptance requirements

**8.1** The product lot is accepted whenever all the quality requirements are met.

**8.2** If part of the specified requirements are not met, a retest shall be permitted on twice the number of specimens used for the initial test from the same lot.

**8.3** If the retest specimen meet all the requirements of this specification, the lot is accepted

## 9 Marking

### 9.1 Bj.L-AS sheets

Each lot of packages and sheets shall be properly tagged with:

- Name, initials or logo of manufacturer and trade name;
- Complete specification of Bj.L-AS, example: Bj.L-AS.20-G300;
- Size, length x width x thickness of base metal, in mm
- Symbol of Aluminium-Zinc alloy coat mass, example: AS 150
- Production code

Product identification marking shall use clear letters and legibly stencilled including the registered name of manufacturer and trade mark.



## 9.2 Bj.L-AS coils

Each coil shall be properly tagged at the beginning and its end with:

- Name, initials or logo of manufacturer and trade name;
- Complete specification of Bj.L-AS, example: Bj.L-AS.20-G300;
- Nominal size, width x thickness of base metal, in mm
- Weight of coil, in metric tonnes;
- Symbol of Aluminium-Zinc alloy coat mass , example: AS 150
- Production code

Product identification marking shall use clear letters and legibly stencilled including the registered name of manufacturer and trade mark.





## Bibliography

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